



## Verification of Environmental Monitoring Technologies

### Technology Profile: Optical Open-Path Monitors

#### Brief Description

Optical open-path monitors are used to provide information about pollutants present in the air. They can continuously monitor air quality and allow early warning of potential non-compliance conditions or emergency release situations. In contrast, "grab sample" analysis by standard methods is both time-consuming and non-continuous. The verification testing involved challenging these monitors with gas samples under realistic operating conditions. The monitors verified rely on a light source (ultraviolet, visible, or infrared) and a detector used together to identify and quantify the levels of certain chemicals in the atmosphere. These monitors can be used to continuously monitor the quality of the air, and, in many cases, are able to simultaneously monitor for several different pollutants. Although their overall design may vary, the basic components of these technologies are similar. The light sources being used for these technologies belong to one of three distinct groups:

- ◆ The monitors using ultraviolet (UV) light have a lamp that emits UV and visible light.
- ◆ The monitors using tunable diode laser (TDL) technology have a laser that provides light over a very narrow spectrum in the near-infrared. This spectral range can be fine-tuned with a single TDL, and can be used over a wider spectrum with multiple TDLs.
- ◆ The Fourier transform infrared (FTIR) monitors use an infrared light source.


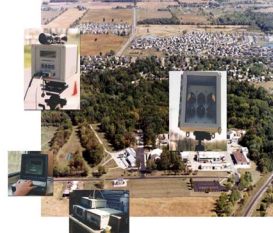


#### How is this important to environmental protection?

Because optical open-path monitors can continuously monitor the air for atmospheric pollutants, they can be valuable tools for detecting air pollution and providing an early warning of potentially serious air pollution problems. Continuous monitoring of emissions from sources of air pollution is important both for increasing the efficiency and safety of industrial processes and for controlling emissions to the environment. Optical open-path monitors can help facility owners and operators meet their need for both regulatory compliance and improved monitoring accuracy.

#### What federal regulatory program does this interface with?

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality standards for six air pollutants: ozone, lead, carbon monoxide, sulfur dioxide, nitrogen dioxide, and respirable particulate matter. The standards were established to protect the public from exposure to harmful amounts of pollutants. Individual states also have ambient standards for NO<sub>2</sub>.

#### Optical Open-Path Monitors Completing Verification Testing

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Additional optical open-path monitors can be verified for other vendors.

## **General Market Information**

### **Who would use this technology? Who would buy it?**

Open path monitors are versatile and can be used to monitor many chemical species in ambient air from a variety of settings. Industries where these monitors may be used include aluminum, steel, cement, glass, power generation, and natural gas. These instruments may be used to monitor emissions from sewage and waste treatment plants, pulp and paper production, fossil fuel combustion, agricultural waste, fertilizer production, incinerators, specialty gas production, and auto exhaust. Gas concentration information obtained in any of these areas can be combined with wind speed and direction data using a computer model to estimate the distribution of a gas cloud over the monitored area.

### **Why are companies having these instruments tested?**

Manufacturers and vendors of optical open path monitors choose to participate in the verification tests to gain additional credibility and more widespread acceptance for their instruments. The verification reports and verification statements signed by EPA and Battelle senior officials aid in marketing their products. Vendors with open path monitors interested in ETV verification should contact Battelle.

## **General Test Information**

### **How are EPA and Battelle Involved?**

The EPA's Environmental Technology Verification (ETV) program was established to accelerate the entrance of improved environmental technologies into domestic and international markets through third-party verification testing and reporting of the technologies' performance. The ETV program provides purchasers and permittees with an independent assessment of the technology they are buying or permitting and facilitates multi-state acceptance. Battelle is EPA's partner in managing the Advanced Monitoring Systems (AMS) Center, whose objective is to verify the performance of commercially ready monitoring technologies for air, water and soil. Battelle, a not-for-profit technology research and development organization, designs and conducts the tests with vendor and stakeholder involvement.

### **What are the factors verified in the test?**

- ◆ Minimum detection limit
- ◆ Accuracy
- ◆ Concentration linearity and source strength linearity
- ◆ Precision
- ◆ Sensitivity

The test procedures provide a range of known concentrations of various target gases to each monitor. Measurements are made with different path lengths (the distance the light travels from the source to the detector), integration times, source intensities, and numbers of replicated measurements to assess the verification parameters listed above. The generic test protocol, verification test reports, and statements for the optical open-path monitors are available on the ETV web site at <http://www.epa.gov/etv>.

### **How long does the testing take?**

For each instrument, the testing covered three days and looked for three separate gases. The AIL Systems monitors tested for tetrachloroethylene, cyclohexane, and ethylene. The OPSIS or UV monitors tested for nitric oxide, benzene, and ammonia. The Boreal and Unisearch diode laser instruments tested for methane, ammonia, and hydrogen fluoride.

### **For more information, contact:**

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